

CLAIMS

1. A watermark information detecting method comprising:
 - image inputting step for reading a printed document with confidential information embedded as an input image, by preparing plural dot patterns with a direction of wave and/or wavelength changed according to an arrangement of dots, giving one symbol to one of the dot patterns and arranging the dot patterns combined with each other;
 - a filtering step for obtaining, in each pixel of the input image, a filter type matrix related to a type of detection filter with a maximum output value among all detection filters and a filter output value matrix related to the output value of the detection filter, by performing filtering of the input image after preparing the detection filter having the same wave direction and wavelength as the dot patterns to be the same number of types in order to detect the dot patterns from the input image;
 - a position searching step for determining the position of the dot patterns in order for the sum of the output values of the detection filter corresponding to a grid point of a position searching template to be maximum, while moving the position searching template in each area divided in a predetermined size with regard to the filter output value matrix;
 - a symbol determining step for obtaining a symbol matrix by determining the symbol of the dot patterns embedded in a location determined in the position searching step from the type of the detection filter in the filter type matrix, corresponding to the location;
 - a border determining step for determining a border of the area; and
 - an information decoding step for decoding the confidential information embedded in the printed document based on the dot patterns embedded inside the border.

2. A watermark information detecting method according to claim 1, wherein, in the border determining step, the border of the area is determined by the dot patterns embedded based on the predetermined dot patterns embedded in the printed document in advance.

3. A watermark information detecting method according to claim 1, wherein, in the border determining step, a row and a column with the specific dot patterns embedded are determined as the border of the area with the confidential information embedded, for the row and the column in the symbol matrix.

4. A watermark information detecting method according to claim 1, wherein the position searching step comprises an initial position searching step for searching the initial position of the position searching template for detecting the dot patterns with high degree of accuracy.

5. A watermark information detecting method according to claim 4, wherein, in the initial position searching step, the initial position of the position searching template is determined at almost the central position of the input image.

6. A watermark information detecting method according to claim 4, wherein, in the initial position searching step, the initial position of the position searching template is determined at the position with most nondense distribution of a pixel with small luminance value of the input image.

7. A watermark information detecting method according to claim 1, wherein, in the position searching step, the position of the dot

patterns is determined by referring to the output value of the detection filter at the neighborhood as well as the output value of the detection filter at the position of the dot patterns to be determined, when searching the position of the dot patterns by the position searching template.

8. A watermark information detecting method according to claim 1 further comprising:

a dot pattern number decoding step for decoding information on the number of dot patterns embedded in the printed document from the input image; and

a position correcting step for correcting the position of the dot patterns when the number of the dot patterns detected from the input image does not match the number of the dot patterns decoded in the dot pattern number decoding step.

9. A watermark information detecting method according to claim 1 further comprising an alteration detecting step including a step of extracting a feature quantity of the printed document and a step of calculating the feature quantity of the input image.

10. A watermark information detecting method according to claim 9, wherein the alteration detecting step further comprises a step of binarizing the input image for binarizing the input image per area in accordance with a binarized parameter per area embedded in the printed document.

11. A watermark information detecting method according to claim 1, wherein, in the border determining step, the dot patterns that can be searched from the symbol matrix are determined in advance

between embedding means and detecting means in the confidential information, to determine the border based on the dot patterns.